*International Journal of Research in Engineering and Science (IJRES)*
*ISSN (Online): 2320-9364, ISSN (Print): 2320-9356*
*www.ijres.org Volume 10 Issue 6 ǁ 2022 ǁ PP. 593-596*

# Application of Buck Boost Converter on Hybrid System

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***Abstract—*** *To fulfill the demand of increasing power supply, we came up with a solution. We will combine two energy resources together and provide the power. The energy used in this system are Renewable source of energies, which is also known as Non-Conventional source of energy. Here we will use wind energy and solar energy. A joint system between wind and solar energy is a system that is being developed is known as Hybrid system. This system has a variable output which is varying as per rate of flow of wind or the radiant light. Due to this we cannot get a constant voltage which can further be processed. So we are using Buck-Boost converter which will help to keep a constant voltage and also help to distribute electricity during any environmental condition.*
***Keywords-*** *Buck-Boost converter, Wind energy, Photovolatic.*

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Date of Submission: 29-05-2022 Date of acceptance: 10-06-2022

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## I. INTRODUCTION

Solar/Wind energy is one of the most important renewable energy sources that have been gaining increased attention in recent years. Solar/Wind energy is plentiful; it has the greatest availability compared to other energy sources. The amount of energy supplied to the earth in one day by the sun is sufficient to power the total energy needs of the earth for one year. Solar/Wind energy is clean and free of emissions, since it does not produce pollutants or byproducts harmful to nature. The conversion of Solar/Wind energy into electrical energy has many application fields. Recently, research and development of low cost flat-panel solar panels, thin-film devices, concentrator systems, and many innovative concepts have increased. In the near future, the costs of small solar-power modular units and solar-power plants will be economically feasible for large-scale production and use of solar energy.

In this paper we have presented the Wind and photovoltaic solar panel's operation. The foremost way to increase the efficiency of a solar panel is to use a Maximum Power point Tracker (MPPT), a power electronic device that significantly increases the system efficiency. By using it the system operates at the Maximum Power Point (MPP) and produces its maximum power output. Thus, an MPPT maximizes the array efficiency, thereby reducing the overall system cost. In addition, we attempt to design the MPPT by using the algorithm of a selected MPPT method which is "Perturb and Observe" and implement it by using a DC- DC Converter. We have found various types of DC-DC converter. Among them we have selected the most suitable converter which is "BUCK/BOOST" converter, for our design.

PV/Wind power generation systems generally use a microcontroller based charge controller connected to a battery and the load. A charge controller is used to maintain the proper charging voltage on the batteries. As the input voltage from the solar array, the charge controller regulates the charge to the batteries preventing any overcharging. So a good, solid and reliable PV/Wind charge controller is a key component of any PV/Wind battery charging system to achieve systems maximum efficiency. Whereas microcontroller based designs are able to provide more intelligent control and thus increases the efficiency of the system.

## II. LITERATURE REVIEW

**A. Huynh D.C & et. all. Maximum power point tracking of solar photovoltaic panels using advanced perturbation and observation algorithm. IEEE June 2013.**

This paper proposes an advanced perturbation and observation (P&O) algorithm for tracking the maximum power point (MPP) of a solar PV panel. Solar PV cells have a non-linear V-I characteristic with a distinct MPP which depends on environmental factors such as temperature and irradiation. In order to continuously harvest maximum power from the solar PV panel, it always has to be operated at its MPP. The proposed P&O algorithm can reduce the main drawbacks commonly related to the P&O algorithm. This is achieved with determining the short-circuit current before each perturbation and observation stage. The obtained simulation results are compared with MPPs achieved using the conventional P&O algorithm under various atmospheric conditions. The results show that the advanced P&O algorithm is better than the conventional P&O algorithms for tracking MPPs of solar PV panels. Additionally, it is simple and can be easily implemented in digital signal processor (DSP).[1]

**B. Grzesaik. W. MPPT Solar Charge Controller for High Voltage Thin Film PV Modules. IEEE May 2006.**

The work deals with a PV battery charge regulator assigned for advanced CdTe modules of output voltage much higher than the popular values of the order 12 or 24 V nominally. As at the same time most of the nominal PV autonomous installation voltages generally remain on the 12 or 24 V level because of convenience, technical tradition and battery features- this high DC module's voltage has to be transformed to a proper lower value by means of DC/DC inverter of possibly high efficiency. A new own developed 60/12 V charge controller solution is presented. This charge controller is equipped with a "step-down" inverter version furnished with modern MPP tracking technique. The choice of MPPT algorithm and its realization by means of microprocessor are explained and discussed as well as final test and measurement results. Very satisfactory exploitation results permit to estimate the solution as a valuable one for the new high voltage modules' market.[2]

**C. Petchjatuporn. P and et. all. A Solar-powered Battery Charger with Neural Network Maximum Power Point Tracking Implemented on a Low-Cost PIC-microcontroller. IEEE Nov 2005.**

This paper presents the development of a maximum power point tracking algorithm using an artificial neural network for a solar power system. By applying a three layers neural network and some simple activation functions, the maximum power point of a solar array can be efficiently tracked. The tracking algorithm integrated with a solar-powered battery charging system has been successfully implemented on a low-cost PIC16F876 RISC-microcontroller without external sensor unit requirement. The experimental results with a commercial solar array show that the proposed algorithm outperforms the conventional controller in terms of tracking speed and mitigation of fluctuation output power in steady state operation. The overall system efficiency is well above 90%.[3]

**D.Longxi. Chang & et. all. A fully integrated solar charger controller with input MPPT regulation protection for 10V to 28V solar-powered panel. IEEE June 2013.**

A fully integrated solar charger controller is presented in this paper. The charger has wide input voltage range about 10V to 28V for the solar-powered panel. The input loop regulation is used here as the MPPT protection. This charger also provides different kinds of battery voltages about 4V to 12V. The controller system uses just one error amplifier and no external compensation components is needed. Besides, this controller has 600 kHz PWM modulation and offers the over-current/overvoltage protection. Other components like bandgap, reference generator, saw-tooth generator, register controller and driver circuits are all implemented in this circuit. This chip is fabricated in a 0.4-µm 5V/40V 2P4M process. The power consumption of this full-integrated solar charger controller IC is about 10mA.[4]

## III. PROBLEM STATEMENT

- The wind mills is one of the source of non-conventional energy power generation though there are some drawbacks of these system.
- When wind power / photovoltaic has a variable output which is changing as per rate of flow of wind / radiant light (i.e. heat from the sun) naturally the output is also varying thus the grid power is variable.
- So we cannot get constant or a span of voltage which further can be processed. This can be easily be replaced by using a buck-boost converter foe wind / photovoltaic energy control.
- We can overcome the problem of voltage variation of the electrical output from wind / photovoltaic system.

- Eventually there have been much advancement in this technology advancement in this technology but the technology but the technology advancement are still needed for wind / photovoltaic power control for different loading conditions.
- By using the buck-boost converter we can keep the voltage constant which is helping for distribution of electricity during any environmental condition.

## IV. OBJECTIVE OF THE PROJECT

The objective of this project was to design a Maximum Power Point Tracker (MPPT) to constantly calculate and maintain the maximum amount of power from a solar panel. By using a DC/DC converter and an arm lpc2148, our team was successfully able to create a system to reach this maximum power. The solar panel was modeled using a DC voltage source, which then was connected to the DC/DC converter. A buck DC/DC converter was used to step the voltage down. This was required to have the voltage be in the acceptable input range for the arm lpc2148. Using the arm lpc2148, a code was created for the Pulse Width Modulation (PWM), which determines the frequency of the PV source. The Perturb and Observe (P&O) method was used to calculate the maximum power the 'PV' source outputs, and the necessary duty cycle for the PWM. That information would then be relayed back to the PV source and adjust it accordingly, to maintain the PV source at the peak power. To test our design, the DC source was adjusted to various voltage inputs, and the maximum power was successfully calculated each time. This project was created using Matlab Simulink software and implemented using a breadboard then solderable board, an arm lpc2148, and a DC voltage source.

## V. PROPOSED SYSTEM

### *A.* Methodology

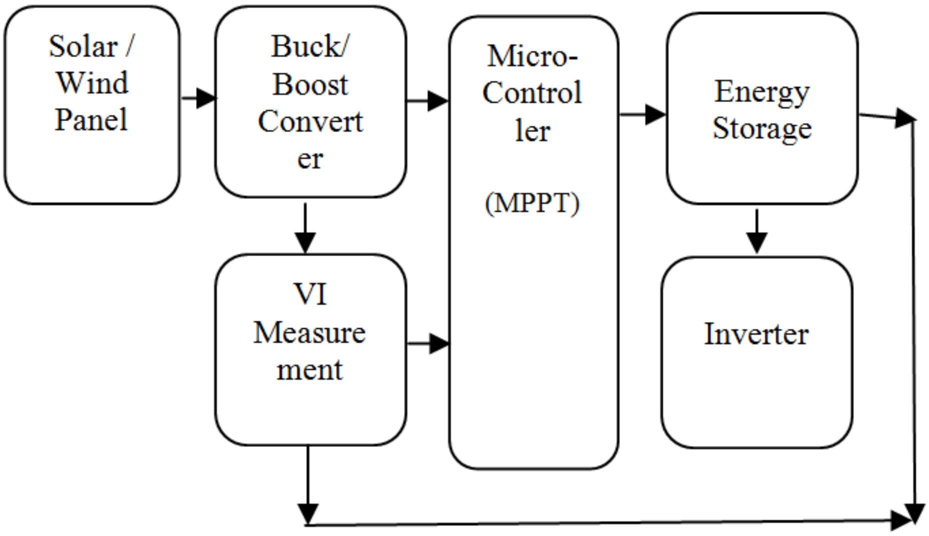


Fig.1Block diagram for tracker circuit

### *B.* Proposed work

1] MCU: The MPPT control circuit is implemented in a microcontroller, that has eight 10-bits analog to-digital (A/D) converters and two four PWM mode signals. The buck converter is controlled by the microcontroller. It read the voltage and current of the solar panels through the A/D port of controller and calculates the output power. It also calculate power by reading the voltage and current of battery side in same way and send corresponding control signal to the buck converter and control the duty cycle of the converter by PWM signal through controller to accordingly increase, decrease or turn off the DC to DC converter. The AVR is a perfect combination of performance, features, and low power consumption for this application. The control circuit compares the PV output power before and after a change in the duty ratio of the DC/DC converter control signal. It is expected that the MPP presents a constant oscillation inherent to the algorithm.

2] DC-DC convertor: There are several topologies available for DC-DC converter. Among them buck converter is in an increasingly popular topology, particularly in battery powered applications, as level of the output voltage can be changed with respect to input voltage. The commonly used a converter in PV systems is a DC/DC power converter. It ensures, through a control action, the transfer of the maximum of electrical power to the load. The structure of the converter is determined according to the load to be supplied. In this article we focus on the step-down DC/DC converter (Buck/Boost converter). MPPT uses the same converter for a different purpose, such as regulating the input voltage at the Maximum power point and providing load matching for the maximum power transfer.

3] MPPT: A typical wind/solar panel converts only 30 to 40 percent of the incident solar irradiation into electrical energy. Maximum power point tracking technique is used to improve the efficiency of the solar panel. According to Maximum Power Transfer technique, the output power of a circuit is maximum when the source impedance matches with the load impedance. In the source side a buck converter is connected to a solar panel in order to enhance the output voltage. By changing the duty cycle of the buck converter appropriately by PWM signal the source impedance is matched with that of the load impedance. There are various MPPT techniques are proposed. Among those methods, the perturb and observe (P&O) and incremental conductance (INC) methods are widely used although they have some problems such as the oscillation around MPP and confusion by rapidly changing atmospheric conditions. In this proposed system perturb and observe MPPT algorithm is used. In this method the controller adjusts the voltage by a small amount from the array and measures power, if the power increases, further adjustments in the direction are tried until power no longer increases. This is called P&O method. Due to ease of implementation and cost effectiveness, it is the most commonly used MPPT method. The voltage to a cell is increased initially, if the output power increase, the voltage is continually increased until the output power starts decreasing. Once the output power starts decreasing, the voltage to the cell decreased until maximum power is reached. This process is continued until the MPPT is obtained. This result is an oscillation of the output power around the MPP. PV module's output power curve as a function of voltage (P-V curve), at the constant irradiance and the constant module temperature, assuming the PV module is operating at a point which is away from the MPP. This P&O algorithm perioconciusiondically increment or decrement the output terminal voltage of the PV cell and comparing the power obtained in the current cycle with the power of the previous one. If the power is increased, then it is supposed that it has moved the operating point closer to the MPP. Thus, further voltage perturbations in the same direction should move the operating point toward the MPP. If the power decreases, the operating point has moved away from the MPP, and the direction of perturbation should be reversed to move back toward the MPP.

4] Storage: Storage device is 12v lead acid dry battery.

## VI. CONCLUSION

Constant dc voltage is found to be improved by the use of the PWM controlling techniques in the Buck-Boost Converter switches incorporated in the wind /photovoltaic. The output dc voltage can be controlled for the values as per simulation between 50- 150 V and output voltage of inverter could be constant automatically. In this way the dc or ac output is improved if wind /photovoltaic output is not constant.

## VII. FUTURE SCOPE

- Wind energy or solar energy play vital role in day to day life.
- The buck-boost converter is useful for control voltage variation for extension we can interface solar power with same system so the output voltage remains constant with the help of buck-boost converter.
- In addition we can use artificial intelligence control instead of PWM technique so that the output voltage becomes more constant and stable.
- Hybrid compact cost effective systems can be designed and implemented so as to generate power.

## REFERENCES

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